APPENDIX F

NUCLEAR, BIOLOGICAL, OR CHEMICAL ENVIRONMENT OPERATIONS

Nuclear, biological, and chemical weapons can cause casualties, destroy or disable equipment, restrict the use of terrain, and disrupt operations. They may be used separately or in combination to supplement conventional weapons. The company must be prepared to fight on an NBC-contaminated battlefield. This appendix prescribes active and passive protection measures to avoid or minimize the effects of NBC weapons. The CO designates principal NBC defense trainers and advisors on NBC defense operations and NBC equipment maintenance. These trainers include an NBC defense officer, a chemical NCO (MOS 54B), and an enlisted alternate. The CO ensures all personnel in his command can operate and perform maintenance on all organic NBC equipment.

Section I. NUCLEAR ENVIRONMENT

Given the massive destructive and disruptive effects of a nuclear blast, it is imperative the rifle company train to reduce the effect of such a blast on operations as much as possible.

F-1. NUCLEAR WEAPONS EFFECTS

Nuclear detonations produce the following main effects: blast, thermal radiation, nuclear radiation, and electromagnetic pulse. The danger from each of these effects depends on the type of weapon, the yield of the weapon, the height of burst, the distance from the detonation, and the hardness of the target.

a. **Blast.** Immediately after a nuclear detonation, a high-pressure shock wave develops. It travels away from the point of detonation in all directions at the speed of sound. This shock wave causes most of the destruction created by a nuclear detonation.

(1) Strong winds caused by the passage of the shock wave propel objects such as tree limbs and debris through the air, turning them into destructive missiles.

(2) Exposed soldiers and structures are vulnerable to blast effects. Personnel inside structures can be hurt by the collapse of the structures; those outside can be hurt by flying debris or be picked up and thrown downwind by the blast wave.

b. **Thermal Radiation**. Intense heat and extremely bright light occur instantaneously with a nuclear detonation.

(1) *Heat.* The intense heat starts fires in buildings, forests, and flammable materials. Such fires may spread quickly because of the burning debris scattered by the blast. The heat can also burn exposed skin, even at long ranges.

(2) *Light.* The light produced by the detonation can cause temporary or permanent blindness. Temporary blindness, called dazzle, from a detonation in daylight may last 5 to 10 minutes. At night, the loss of vision will last longer because the eyes will probably have adapted to the dark. The light can injure eyes permanently if it causes burns within the eye itself. This is apt to occur to those soldiers who are looking in the direction of the fireball at the instant of detonation.

c. **Nuclear Radiation**. A nuclear detonation produces two types of nuclear radiation--initial and residual. Both types can injure or kill soldiers.

(1) *Initial.* This is radiation emitted within the first minute after detonation. It travels at the speed of light and damages human tissue and blood-forming cells. Since initial nuclear radiation travels so fast, the only way to be protected from it is to be in a protected position before the detonation.

(2) *Residual*. This is radiation that lasts after the first minute. It consists mostly of neutron-induced radiation and fallout.

(a) Neutron-induced radiation is produced by high-speed neutrons produced by the explosion. It exists only in the vicinity of the point of detonation. The intensity and extent of this radiation depends on the type of soil at the point of detonation, the height of the burst, and the type and yield of the weapon. The only significant source of residual radiation from an airburst weapon is neutron-induced radiation in the soil in a symmetrical pattern beneath the point of detonation.

(b) Militarily significant fallout is produced with a surface burst when material from the earth is drawn into the fireball, vaporized, and combined with radioactive material to form radioactive particles, which condense then fall back to earth. The larger particles fall back right away near the point of detonation. The smaller particles are carried by the winds until they gradually settle to the earth's surface. The area contaminated by fallout may extend over many thousands of square kilometers.

d. **Electromagnetic Pulse**. This is a massive surge of electrical power, similar to an extremely strong radio signal. It occurs within seconds of a nuclear detonation and is transmitted through the air in all directions from the point of detonation. EMP can damage electrical (especially solid-state) components of equipment (radios, radars, computers, and vehicles) and weapon systems (TOWs and Dragons).

F-2. NUCLEAR BURSTS

The different types of nuclear bursts are airbursts, surface bursts, and subsurface bursts.

a. An airburst occurs when a weapon detonates above the ground so that the fireball does not touch the earth's surface. Fallout or radioactive material from an airburst is military insignificant unless rain or snow falls through the radioactive cloud and brings the material to earth. Neutron-induced radiation is the major radiation hazard.

b. A surface burst occurs when a nuclear weapon detonates at such a height that the fireball touches the surface of the earth. Blast, thermal radiation, and initial nuclear radiation are not as widespread as from an airburst. Induced radiation is present, but it is masked by fallout. The fallout produced by a surface burst is a dangerous hazard because it can cover a large area with high levels of radioactivity.

c. A subsurface burst occurs when a nuclear weapon detonates beneath the surface of the earth. If the fireball breaks through the earth's surface, local fallout can be produced. Thermal radiation will not be a significant hazard because it is absorbed by the soil. Blast effects are also reduced, but shock waves passing through the ground or water will extend for some distance. Residual radiation will occur in and around the crater.

F-3. NUCLEAR HAZARD WARNING

To warn the company of a friendly nuclear detonation, the battalion normally issues a warning message. The format for this warning is normally prescribed by unit SOP and should contain a proword indicating that the message is a nuclear strike warning. It also prescribes what protective measures to take or gives the orders to evacuate the area. The warning indicates the expected time and general location of the detonation. Once the warning is received by the company, the CO disseminates it through the company using the chain of command. He also specifies the protective measures.

F-4. NUCLEAR HAZARD ALARM

The company SOP should prescribe a nuclear hazard alarm and also a signal to indicate that the hazard is no longer present.

a. The standard nuclear hazard alarm is the vocal alarm, FALLOUT. The standard signal for indicating that the hazard is no longer present is the vocal signal, ALL CLEAR.

b. As soon as a nuclear hazard is detected, the nuclear hazard alarm should be given. It can be given by any soldier detecting the hazard. Once the alarm has been initiated, it must be passed throughout the company as quickly as possible. When the hazard no longer exists, the ALL CLEAR signal is given. This is normally initiated by the CO and then passed throughout the company as quickly as possible.

F-5. PROTECTION

The best protection from the immediate effects of a nuclear detonation is to take cover in fighting positions, culverts, ditches, or behind hills. Soldiers should drop immediately, face down with their head towards the blast, close their eyes, and cover all exposed skin. They must stay down until the blast wave passes and until the debris stops falling. Then they check for (and treat) injuries, check damage to equipment and supplies, and prepare to continue the mission.

a. Radiation is the only nuclear effect that remains after a nuclear detonation. It may last for days or even years, and it may cover a large area. Since radiation cannot be detected by human senses, radiac equipment must be used to detect its presence. The procedures for radiological monitoring, surveying, and reporting must be prescribed by SOP (FMs 3-3 and 3-4).

b. If the company must stay in a fallout area, all soldiers should stay in positions with overhead cover as much as possible. They should cover their mouths and noses with scarves or handkerchiefs to keep from inhaling radioactive particles. The company continually monitors the radiation level in the area.

c. Once the fallout has passed, soldiers brush the radioactive dust off their clothing and scrape the dirt from the area immediately around them. Radiacmeter operators continue to monitor and report radiation levels. All soldiers should wash themselves and their equipment whenever possible. The time the company may stay in a contaminated area depends on the amount of radiation to which its soldiers have been exposed, the intensity of the radiation, the protection available, and the needs of the mission.

F-6. RADIATION LEVELS

When fighting in a nuclear environment, the company closely monitors the amount of radiation that its soldiers have already absorbed (dose) and the amount to which they are being exposed (dose rate). To do this, the company uses the IM-93A/UD dosimeter and the IM-174A/PD radiacmeter. The IM-93A/ UD dosimeter is normally carried by a small-unit leader.

a. **IM-93A/UD Dosimeter**. This meter indicates the total radiation dose received by soldiers. It is the size of a fountain pen and easy to read. Each platoon is normally assigned two of IM-93s. Platoon leaders maintain a record of the times and amounts of each reading. The frequency of the readings and reports is set by the company SOP. At prescribed time intervals, the platoon leaders report their readings to the CO. The company NBC NCO consolidates these reports from the platoons and sends the consolidated report to battalion. The format for this report is normally prescribed by SOP (FM 3-3).

NOTE: For military purposes, one roentgen equals one centigray. The radiation received by a man is measured and expressed in cGys.

b. **IM-174A/PD Radiacmeter**. This is used for area monitoring and survey. It measures gamma radiation in units from 0 to 500 cGys per hour.

(1) All soldiers must be trained in the use and maintenance of these devices and in techniques of radiological monitoring and survey.

(2) Radiological monitoring and survey starts on the order of the CO or IAW the SOP. When a contaminated area is detected, the radiological monitoring and survey personnel mark the area with radiological contamination markers. They also record and report to the CO the radiation dose rates and the time and location of each reading. The company NBC NCO consolidates these reports and sends the information to battalion, using the NBC 4 report.

(3) The radiological monitoring and survey personnel conduct either periodic or continuous monitoring (FM 3-3). During periodic monitoring, they monitor different points within the company area at least once each hour. They conduct continuous monitoring when—

- The company gets a fallout warning.
- The company is moving.
- A nuclear detonation is reported, seen, or heard.
- Radiation above 1 cGy per hour is detected by periodic monitoring.
- Ordered by the commander.

(4) Continuous monitoring stops on order from the commander or when the dose rate falls below 1 cGy per hour (except for units on the move, since they could enter a contaminated area anytime en route).

Section II. CHEMICAL OR BIOLOGICAL ENVIRONMENT

Since many possible enemy forces have chemical/biological weapons, the company may have to fight under active CB conditions. These weapons may be used alone or with nuclear or conventional weapons. Regardless of how these weapons are used, the company must be able to survive and continue its combat mission. To ensure this, the company must be trained to meet the NBC standards of proficiency prescribed in AR 350-42.

F-7. CHARACTERISTICS OF CHEMICAL AGENTS

Chemical agents are used to kill or injure humans. They can cover large areas and may be placed on a target as a vapor, liquid, or aerosol. A mixture of agents can be used to cause confusion and casualties. Chemical agents can be disseminated by artillery, mortars, rockets, missiles, aircraft spray, bombs, and landmines.

F-8. CHARACTERISTICS OF BIOLOGICAL AGENTS

Biological agents are disease-producing germs. These agents may be dispersed as aerosols by generators, explosives, bomblets, missiles, and aircraft. Harmful germs may also be spread by the release of infected insects, such as flies, mosquitos, fleas, and ticks.

F-9. EFFECTS ON SOLDIERS

CB agents may enter the body through the eyes, nose, mouth, or skin; they can cause sickness or death. Liquid agents may be dispersed in water and on equipment, terrain, and foliage. The agent may stay for hours or days, causing a hazard to unprotected soldiers.

F-10. EFFECTS ON EQUIPMENT

CB agents have little direct effect on the mechanical operation of equipment. However, liquid chemical-agent contamination on equipment can restrict the equipment use until it is decontaminated. The company must be prepared to decontaminate its vehicles and equipment. The CO should use information from FM 3-5 to assist in decontamination of his vehicles, equipment, and personnel.

F-11. EFFECTS ON TERRAIN

Liquid chemical agents may restrict the use of terrain and buildings. The company does not decontaminate terrain. Therefore, the company should bypass contaminated areas when possible. When this is not possible, the company may cross contaminated areas after soldiers put on appropriate pieces of protective clothing.

F-12. DETECTION OF CHEMICAL AGENTS

The senses may not be able to detect chemical agents because some agents are odorless, colorless, and tasteless. Therefore, chemical agents must be detected by using the M8A1 manpacked, automatic chemical-agent alarm; the ABC-M8 chemical-agent detector paper; or the M256 chemical-agent detector kit (FM 3-4). Observation of the delivery system may also provide early warning. Aerial spraying by fixed or rotary wing aircraft and munitions that do not detonate with the usual HE blast are indicators of possible chemical attack.

F-13. DETECTION OF BIOLOGICAL AGENTS

Biological agents are extremely difficult to detect. Soldiers must be alert to any indication that biological agents are being used. Any unusual sickness in soldiers or civilians should be reported promptly.

F-l4. PROTECTIVE MEASURES

The best protective measure against NBC attacks is avoidance. The CO ensures his company is prepared for and protected against an NBC attack. He uses the terrain and disperses his unit to protect it. He also ensures that detection and monitoring equipment is used properly. Other protective measures include warning signals, protective equipment and clothing, and treatment of casualties.

a. **Warning Signals**. Company SOP should prescribe a primary and alternate warning signal for alerting soldiers that chemical or biological agents have been detected. The warning signals must be disseminated throughout the company and understood by all soldiers. Anyone detecting the use of chemical or biological agents should give the warning signal.

b. **Protective Equipment and Clothing**. A soldier's primary protection against a CB attack is his protective mask that protects his face, eyes, and respiratory tract.

(1) *Chemical attack*. For full protection against liquid chemical agents, soldiers must wear their protective masks and hoods and chemical-protective overgarments, overboots, and gloves (FM 3-4).

(a) Once chemical agents have been used or while the threat of a chemical attack exists, the CO must decide whether the protective mask and the chemical-protective clothing will be worn (this is called mission-oriented protective posture), carried, or stored in the trains. When feasible, the CO specifies the degree of protection before a mission. (The minimum degree of protection may be prescribed by battalion or higher level.) Later, he may direct that the protection be modified according to the threat, temperature, and workload.

(b) The MOPP level directed by the CO will determine what equipment and clothing must be worn and used, and what precautionary measures must be applied. Therefore, it is essential that the CO and his subordinate leaders be familiar with MOPP levels (Figure F-1). (See Chapter 2, FM 3-4 for a detailed discussion on MOPP and the use of MOPP tables.) MOPP procedures should be stated in the company's SOP.

(2) *Biological attack.* The best defense against biological agents is strict enforcement of all preventive medical and field sanitation measures along with high standards of personal hygiene. The duty uniform and gloves protect against bites from insects (such as mosquitoes and ticks) that may carry disease-causing germs. Clothing should be buttoned

and trouser legs should be tucked into the boots. Covering the skin reduces the possibility of biological agents entering the body through cuts and scratches. It also keeps disease-carrying insects from reaching the skin. Insect repellents and insecticides are effective against most disease-carrying insects. High standards of sanitation also improve protection against some insects.

c. **Treatment of Chemical-Agent Casualties**. The casualties from a chemical attack must be treated as soon as possible to prevent further injuries or complications. This treatment includes both first-aid measures and decontamination. Casualty treatment and evacuation plans must ensure that contaminated casualties are separated from noncontaminated casualties. The symptoms and first-aid steps for chemical agents are as follows:

(1) *Nerve agents*. The symptoms of nerve-agent poisoning are unexplained runny nose, blurred vision, tightness in the chest, difficulty in breathing, drooling, nausea, twitching, and convulsions. The injection of a nerve agent antidote is the first-aid measure for soldiers showing symptoms of nerve-agent poisoning. A soldier gives himself the contents of one nerve agent antidote kit when he experiences these symptoms. If symptons persist after 5 to 10 minutes, a buddy may administer additional kits as required.

MOPP	OVERGARMENT	OVERBOOTS	MASK/HOOD	GLOVES
0	Readily available	Readily available	Carried	Readily available
1	Worn, opened or closed based on temperature	Carried	Carried	Carried
2	Same as MOPP 1	Worn	Carried	Carried
3	Same as MOPP 1	Worn	Worn, opened or closed based on temperature	Carried
4	Worn, closed	Worn	Worn	Worn

Table F-1. Protective equipment and clothing for MOPP levels.

(2) *Blister agents*. The symptoms of blister-agent poisoning are redness of the skin in 4 to 6 hours and blisters in 6 to 12 hours after exposure. These symptoms may be delayed for several hours or days, depending on the type agent used. There is no first aid for blister-agent poisoning other than decontamination. If burns or blisters develop after decontamination, soldiers cover the area with sterile gauze or a clean cloth to prevent infection. The blisters should not be broken. However, if they break, they should be treated as open wounds.

(3) *Blood agents*. The symptoms of blood-agent poisoning are increased breathing rate, dull throbbing headache, and nausea. There is no self-aid or buddy treatment for blood agent symptoms; victims must seek medical treatment.

(4) *Choking agents*. The symptoms of choking - agent poisoning are coughing, choking, nausea, and headache. The first aid for choking-agent poisoning is to keep the affected soldier still, warm, and comfortable. He should not be moved unless necessary.

d. **Decontamination of Soldiers and Their Equipment**. All soldiers must know decontamination procedures.

(1) *Chemical agent*. A soldier has an M258A1 skin decontaminating kit. (See FM 3-5 for instructions on the use of this kit.)

(2) *Biological agent*. Soldiers decontaminate themselves by showering with soap and hot water. Germicidal soaps are used if available. The nails should be thoroughly cleaned, and the hairy parts of the body should be scrubbed. Contaminated clothing is washed in hot, soapy water if it cannot be sent to a field laundry; cotton items may be boiled. Soldiers wash their contaminated equipment in hot, soapy water and allow it to air out.

(3) *Equipment and vehicles*. Equipment, individual weapons, and clothing can be decontaminated with the M258A1 decon kit.

(a) Overgarments need to be exchanged after becoming contaminated. The MOPP gear exchange is a safe method for removing overgarments and all gross contamination from individual soldiers. (FM 3-5 provides detailed instructions for MOPP gear exchange.)

(b) Gross contamination can be removed from vehicles by washing them. Battalion-level decontamination apparatus and crew supervised by a 54B chemical specialist link up with the contaminated elements as they move between fighting positions. They spray the vehicles with hot, soapy water. This limits the spread of contamination. MOPP gear exchange and vehicle washdown are the two techniques in hasty decontamination (FM 3-5).

(c) When the situation permits, the MOPP gear exchange suits and equipment should be prepositioned in the vicinity of the company. This will allow the flexibility to rotate squads or platoons to the hasty decontamination site.

e. **Crossing Contaminated Areas**. The company should cross a contaminated area only when it is essential to accomplish the mission or for the survival of the unit. When directed to cross a contaminated area by battalion, the CO should carefully select a route that minimizes the unit's exposure. (FM 3-3) Information from battalion and reconnaissance by the company will provide the required information to plan the crossing.

(1) *Chemical contamination*. Before conducting the crossing, the CO must plan for a hasty decontamination on the far side of the contaminated area, requiring clean MOPP suits and decontamination equipment. The unit must either carry this equipment or have it delivered to the decontamination site. The company crosses in MOPP4 using M9 chemical detection paper to indicate the presence of a liquid agent. After moving a safe distance beyond the contaminated area, the CO decides if he will conduct hasty decontamination by testing with the unit's detection equipment. If contamination is present, he must decide whether to continue the mission and decontaminate later or to do it now. To decontaminate now, the company conducts MOPP gear exchange and decontaminates their individual equipment. The unit then moves a minimum of 500 meters to a clean location and tests for chemical contamination. If no chemical contamination is detected, the company begins unmasking procedures to reduce the MOPP level. When they finish, the CO establishes the appropriate MOPP level and continues the mission. If the company has excessive amounts of liquid contamination on their weapons and equipment, it may be impossible to decontaminate properly with the

available decontamination kits and equipment. If this occurs, the unit will be required to continue the mission while still in MOPP4.

(2) *Radiological contamination*. The primary concern is to avoid the areas of highest radioactivity and to cross the others as quickly as possible. The soldiers must avoid inhaling radioactive dust or particles by covering their mouths with a damp rag or wearing their protective masks if nothing else is available. If the crossing is expected to be very dusty, the MOPP suits may be worn to assist the decontamination on the far side. During the crossing, check individual soldier's dosimeters to ensure the OEG is not exceeded. Once across, the unit moves a safe distance away from the area (500 meters) where the CO determines the extent of soldier/vehicle contamination and decides whether to perform decontamination now or later. Decontamination is conducted by removing all dust and dirt that may have been picked up by the unit during its crossing. If MOPP suits were worn, they must be discarded. If protective masks were worn during the crossing, the filters must be replaced.

f. **Field Expedient MOPP Suits.** When the CO conducts his risk assessment, he may have decided the threat of chemical attack was low; therefore, the unit's MOPP gear may not be immediately available. Or, the unit may have used all of its MOPP suits and be waiting for resupply. In either case, if this unit encounters a chemical hazard, it must use one of the following field expedient protective measures.

(1) *Wet weather gear with chemical gloves, wet weather boots, and protective masks*. This ensemble protects the soldier well against all vapor agents, but not well against liquids. Liquid agents penetrate these garments much quicker then the MOPP suit. Once contaminated, the wet weather clothing is discarded because it cannot be decontaminated and reused.

(2) *BDUs with chemical gloves, wet weather boots, and protective masks.* The BDUs should be taped to the gloves and boots. This ensemble gives marginal protection against liquids and mustard agent vapors. Once contaminated, the BDU material is penetrated very quickly and must be removed and discarded.

(3) *Poncho with wet weather boots and protective mask.* The poncho can be used as a garment, or over a fighting or sleeping position as a disposable cover. It is penetrated very quickly by liquid agents and must be discarded after being contaminated.

(4) *MOPP suits are not always essential*. When attacked with nonpersistent nerve, choking, riot control, and blood agents—the protective mask alone will provide adequate protection as long as no liquid agent is present.

g. **Field Expedient Decontamination Measures.** A unit may also conduct field expedient decontamination. In the absence of issued decontaminants, any bleach or organic solvent will work. Earth, fire, water, and even sunlight can also be used for this purpose. A point to remember is to decontaminate something, it does not necessarily have to be chemically neutralized. It is only necessary to remove, seal, or cover the agent.